

Water Reclamation and Reuse Program  
General Sewer Plan & Facility Plan Development  
Reliability Assessment Guidance

General: The level of detail required to address water reclamation and reuse standards for system and process reliability in general sewer plans and facility plans requires specific guidance. WAC 173-240 requires the level of detail that will allow the development of construction plans and specifications, where as the level of detail required by Department of Health per WAC 246-271 for planning documents do not address details technical details. However, the Water Reclamation & Reuse Standards require the development and approval of an engineering report that would follow the planning effort that would provide this level of detail. The differences in the level of engineering detail that are required by the planning documents between the Departments of Health and Ecology require some definition.

To further complicate the development, specific reliability issues that will establish the facility and process reliability system cannot be determined until the facilities are well into the detailed design phase, which occurs after the development and approval of the facility plan. Again, specific guidance is necessary to define the appropriate level of detail that is acceptable to the departments in order to be able to approve wastewater planning documents.

Description: The level of detail of a facility plan's reliability assessment should be limited to an adequate description of the purpose and scope of the reclamation facility's reliability system. The description should identify control system goals, essential reliability features and procedures, equipment and process redundancy and reliability, alarm system features and the basic control scheme. A checklist identifying conformance with reliability criteria from the Water Reclamation & Reuse Standards should also be included.

Process & control system reliability goals:

A general description of the control system goal and approach is necessary. This is a description of the basic control scheme. The control system must assure "adequate and reliable treatment" required for the reclaimed water classification is provided at all times. The control system will respond to these requirements by mechanical or electrical devices or through operator surveillance and intervention. In addition, reliability and redundancy requirements are dependent upon the level of sophistication of the treatment processes used, and the sensitivity of those processes to upset. Finally, reliability is dependent upon the ability of operations and control systems to monitor and detect process and equipment malfunctions, the capability for and ease of repair and parts availability.

Therefore, the facility plan must identify the fundamental process and control system goals. For example, the goal of a system could be based on the concept and goal of providing treatment from common unit processes, or rely on new, innovative processes. The design of these facilities may be relatively conservative, resulting in inefficient treatment, but are not sensitive to upstream process upsets. Conversely, the design could be based on highly efficient treatment processes, and utilized a crescendo of controls and redundant equipment and basins to assure reliable treatment. The control system may be simple, monitoring basic system parameters such as flow, or could be based on integrated system signals relating plant flow to unit chemical flows, process parameters and unit loading rates. Finally, alarm system responses can be simplified to control at a central point with diversion to storage or disposal, or could be based on alarms individual processes at major equipment locations that would call backup equipment, or provide bypass to short term storage or re-routing to the head of the plant.

Reliability features & procedures:

Process and equipment reliability will be provided through equipment and / or process alarm responses, redundancy, emergency storage or alternative disposal. The facility plan must identify which of these individual approaches or combinations will be used. The facility plan must identify whether or not the facility will rely upon a permitted wastewater disposal site, long term or short term storage or multiple treatment trains or unit processes. In addition, general alarm responses to critical, major or minor alarm conditions must be determined.

For example, a facility plan for a Class A reclamation facility might identify the response to a critical alarm resulting from loss of filtration as immediate diversion to a long-term storage pond (greater than 20 days retention). Similarly, the plant's control system may respond to a major alarm condition such as filter effluent quality greater than 5 NTU by immediate diversion to a second filter, diversion to short term storage or diversion to a permitted discharge site or reclamation use area permitted for a lower quality reclaimed water, such as fodder crop irrigation site.

Equipment and process redundancy & reliability features:

Some level of decision must be made regarding basic control parameters, and these must be identified in the facility plan. For example, plant influent flow rate can be the basis to assure hydraulic loadings are not exceeded, causing alarm conditions. Flow switches can be incorporated to assure chemical feed is actually occurs, turbidimeters can be incorporated to assess filtration efficiency, limit switches can be used to assure valve function and power to pump motors can be used to control flow into individual processes along with process valves.

The process design and control system decisions made at the facility planning stage must identify the fundamental control scheme at the process level. The decisions as to whether or not process loading will be based on continuous or intermittently measured influent flows, whether or not process loading will be controlled by automated valves, pumps or a combination, and what process parameters will be monitored can be identified. And decision regarding control parameters such as dissolved oxygen, BOD, suspended solids, turbidity, chlorine residual, or UV light intensity or transmittance should be made.

Alarm system features:

The facility plan must identify fundamental alarm system features. These features should identify a hierarchy of alarm conditions, such as critical, major and minor alarm conditions. The plan must identify those fundamental process up-sets, equipment loss and monitoring parameters that will trigger these alarm conditions. Finally, the plan must identify general system response to the alarm conditions, such as immediate diversion to storage or disposal for any critical alarm, or to allow for specified response time by the operator to address and repair the cause of a major alarm.

Reclamation standards checklist:

Finally, the checklist of reliability requirements from the Water Reclamation & Reuse Standards should be included. At this stage, the plan should identify the level of consideration made for each of the system identified as "included", "deleted" or "deferred to design".

<b>Alarms</b>	<b>Required</b>	<b>Optional</b>	<b>Included</b>	<b>Deleted</b>	<b>Deferred to Design</b>
Loss of power from normal power supply	✓				
Biological treatment process failure	✓				
Disinfection process failure	✓				
Coagulation process failure	✓				
Filtration process failure	✓				
Alarms independent of normal power supply	✓				
Personnel notified:	✓				
Plant operator					
Superintendent					
Other:					
Master alarm:					
Inter-connect all site alarms	✓				
Location- convenient observation by attendant	✓				
<b><i>Less than 24 hour plant attendance:</i></b>					
Alarms interconnected to	✓				
Police station					
Fire station					
Other full-time service unit:					

Reclamation Standards Reliability Requirements	Required <sup>1</sup>	Optional <sup>2</sup>	Provided	Deleted	Deferred to Design
<b>Power Supply Reliability.<sup>3</sup></b>					
Alarm and standby power source					
Alarm & automatically actuated short term storage or disposal					
Automatically actuated long term storage/disposal					
Storage without alternative disposal system					
Retain reclaimed water under adverse weather conditions					
Wet weather conditions: Retain reclaimed water during 10-year storm as determined from on 20 years of weather data					
Minimum storage capacity: $V = 3 \times Q_{\text{Ave Day}}$					
<b>Emergency Storage &amp; Disposal</b>					
Short-term emergency storage					
Facility reserved solely for reclaimed wastewater storage or disposal					
Minimum of 24 hour storage period					
All equipment provided with standby power or independent of normal power source					
Pumping & pump-back equipment provided					
Long term emergency storage					

<sup>1</sup> Required reliability features must be provided even if optional reliability features are provided unless approved by the regulatory agencies

<sup>2</sup> Optional reliability features: one or more can be provided in addition to required reliability features

<sup>3</sup> Provide at least one reliability feature

Reclamation Standards Reliability Requirements	Required <sup>1</sup>	Optional <sup>2</sup>	Provided	Deleted	Deferred to Design
Diversion to alternative, approved reuse site					
Diversion to discharge point approved by Department of Ecology					
Automatically actuated emergency storage provisions					
Fully automated diversion					
Untreated or partially treated effluent					
Treatment process failure					
Manual reset to prevent automatic restart					
Biological Treatment					
Alarm & multiple treatment units capable producing oxidized wastewater with one unit inoperable		✓			
Alarm & short-term storage/disposal provisions with standby replacement equipment		✓			
Alarm & long term storage or disposal		✓			
Automatically actuated long-term storage or disposal provisions		✓			
Secondary Sedimentation					
Multiple sedimentation units capable of treating the entire flow with one unit inoperable		✓			
Standby sedimentation unit process		✓			
Long term storage or disposal provisions		✓			
Coagulation					
Standby by feeders	✓				
Adequate chemical storage & conveyance facilities	✓				
Adequate reserve chemical supply	✓				
Automatic dosage control	✓				
Alarm & multiple treatment units capable producing oxidized wastewater w/1 unit inoperable		✓			
Alarm & short-term storage/disposal provisions with standby replacement equipment		✓			
Alarm & long term storage or disposal		✓			
Automatically actuated long-term storage or disposal provisions		✓			
Filtration					
Alarm & multiple filter units capable treating the entire flow with one unit inoperable		✓			
Alarm & short-term storage/disposal provisions with standby replacement equipment		✓			
Alarm & long term storage or disposal		✓			
Automatically actuated long-term storage or disposal provisions		✓			
Alarm & standby filtration unit process		✓			
Disinfection					
Standby by chlorinator	✓				
Standby chlorine supply	✓				
Manifold system to connect chlorine cylinders	✓				

Facility Plan Reliability Checklist.doc

Reclamation Standards Reliability Requirements	Required <sup>1</sup>	Optional <sup>2</sup>	Provided	Deleted	Deferred to Design
Chlorine scales	✓				
Automatic switchover to full chlorine cylinders	✓				
Continuous Cl <sub>2</sub> residual measuring & recording	✓				
Alarm & standby chlorinator		✓			
Alarm & short-term storage/disposal provisions with standby replacement equipment		✓			
Alarm & long term storage or disposal		✓			
Automatically actuated long-term storage or disposal provisions		✓			
Alarm & multiple point chlorination; each point of chlorination includes:		✓			
independent power source		✓			
separate chlorinator		✓			
separate chlorine supply		✓			